

National Green Hydrogen Mission

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In news– The government has formally approved the National Green Hydrogen Mission with a stated aim of making India a global hub for the production of green hydrogen.

About the Mission-

- It is **aimed at the creation of export opportunities for green hydrogen and its derivatives; decarbonisation of the energy sector** and use in mobility applications in a bid to lower the dependence on imported fossil fuels; and the development of indigenous manufacturing capacities.
- The **ultimate aim is to fuel key sectors of the economy using hydrogen** that is made by splitting water through an electrical process called electrolysis, using a device called electrolyser that is powered entirely by renewable energy.
- **India's Mission was first announced by the Prime Minister in his Independence Day speech in 2021.**
- The Ministry of New and Renewable Energy is in the process of formulating guidelines for the scheme that seeks to promote the development of green hydrogen production capacity of at least 5 million metric tonnes (MMT) per annum with an associated renewable energy capacity addition of about 125 gigawatts (GW) by 2030.
- **A major part of this is a proposed Strategic Interventions for Green Hydrogen Transition Programme (SIGHT)**, under which two financial incentive mechanisms – targeting domestic manufacturing of electrolysers and the production of green hydrogen – will be promoted to achieve a reduction in fossil fuel imports and abatement of annual greenhouse gas emissions by 2030.

- The draft Mission document is likely to propose support for production and deployment of green hydrogen, alongside a major push for hydrogen in the auto sector – R&D for fuel cell development and pilot projects for fuel cell vehicles.
- **In the proposed Mission, the steel sector has been made a stakeholder**, and it has been proposed to set up pilot plants with part funding from the government to explore the feasibility of using green hydrogen in Direct Reduced Iron (DRI) production by partly replacing natural gas with hydrogen in gas-based DRI plants.
- Based on the success of the pilot projects, the gas-based DRI units are to be encouraged for large-scale adoption of the process.

Hydrogen as a fuel

- **Hydrogen, the most common element in nature, exists only in combination with other elements**, and has to be extracted from naturally occurring compounds like water (which is a combination of two hydrogen atoms and one oxygen atom).
- Hydrogen is a clean molecule, but the process of extracting it is energy intensive.
- **While hydrogen's potential as a clean fuel source has a history of nearly 150 years**, it was only after the oil price shocks of the 1970s that the possibility of hydrogen replacing fossil fuels came to be considered seriously.
- Three carmakers – Japan's Honda and Toyota, and South Korea's Hyundai – having since moved decisively to commercialise the technology, albeit on a limited scale.
- **The sources and processes by which hydrogen is derived are categorised by colour tabs.**
 - **Hydrogen produced from fossil fuels is called grey hydrogen**, which constitutes the bulk of the hydrogen generated today.

- Hydrogen generated from fossil fuels with carbon capture and storage options is called **blue hydrogen**,
- Hydrogen generated using electrolysers powered by renewable power sources is called **green hydrogen**.

Green hydrogen potential-

- Green hydrogen has specific advantages. One, it is **a clean burning molecule that can decarbonise a range of sectors including iron and steel, chemicals, and transportation**.
- Two, renewable energy that cannot be stored or used by the grid can be channeled to produce hydrogen.
- Green hydrogen is not commercially viable at present.
- The current cost in India is around Rs 350-400 per kg; it is likely to become viable only at a production cost of under Rs 100/ kg. This is what the Hydrogen Energy Mission aims for.

Auto sector, fuel cells-

- **Hydrogen is an energy carrier, not a source of energy. Hydrogen fuel must be transformed into electricity by a device called a fuel cell stack** before it can be used to power a car or truck.
- **A fuel cell converts chemical energy into electrical energy** using oxidising agents through an oxidation-reduction reaction.
- **Fuel cell-based vehicles most commonly combine hydrogen and oxygen to produce electricity to power the electric motor on board**.
- Since fuel cell vehicles use electricity to run, they are considered electric vehicles (EVs).
- Inside each fuel cell, hydrogen is drawn from an onboard pressurised tank and made to react with a catalyst, usually made from platinum.
- As the hydrogen passes through the catalyst, it is

stripped of its electrons, which are forced to move along an external circuit, producing an electrical current. This current is used by the electric motor to power the vehicle, with the only byproduct being water vapour.

- **Hydrogen fuel cell cars have a near-zero carbon footprint. Hydrogen is about 2-3 times as efficient as burning petrol,** because an electric chemical reaction is much more efficient than combustion. **The Toyota Mirai and the Honda Clarity cars are powered by fuel cells.**

Note:

- India's electricity grid is predominantly coal-based and will continue to be so, thus negating collateral benefits from a major EV push – as coal will have to be burnt to generate the electricity that will power these vehicles.
- In several countries that are pushing EVs, much of the electricity is generated from renewables – in **Norway for example, 99 percent is hydroelectric power.**
- **In April 2022, state-owned Oil India Limited commissioned India's first 99.99 percent pure green hydrogen plant in Jorhat, Assam.**
- **Kerala has set up a high-level working group for its own Hydrogen Economy Mission** to devise a strategic roadmap, policy formulations, and implementation plans for facilitating investments in green hydrogen and making the state “a green hydrogen hub”.
- **Indian Oil Corporation Ltd's R&D centre, in collaboration with Tata Motor Limited, had earlier carried out trials of hydrogen fuel cell buses.**
- Companies such as Reliance Industries Ltd, Adani Enterprises, JSW Energy, and Acme Solar have plans to tap the green hydrogen opportunity.
- Adani announced in June that it will collaborate with

France's Total Energies to jointly create the **“world's largest green hydrogen ecosystem”**.

- US-based Ohmium International has commissioned **India's first green-hydrogen factory in Karnataka.**